Some Existential Interpretations: The Role of Pitch and Duration in the English Quantity Implicature

A Senior Honors Thesis

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by

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Abstract

The sentence “Some kids crossed the street.” has varying interpretations depending on the speaker’s pronunciation. It could mean “some, but not all, the kids crossed the street,” or it could mean “some, and possibly all, the kids crossed the street.” The first interpretation is thought to be based on an inference from the domain of cognition referred to as pragmatics. The second is thought to stem from truth-conditional semantics. My project seeks to examine the role that pitch and vowel duration play in the interpretation of these sentences with English-speaking adults. I also would like to determine whether executive function is predictive of the interpretation of the word ‘some.’

In light of the COVID-19 pandemic, I have created a totally remote and novel experiment package that participants could complete at home on their own computers. Executive function was evaluated via an online survey. The actual experiment portion is a series of videos that feature four characters. Either some or all of the characters complete an action and then the narrator makes a statement, such as "Some kids crossed the street." There are four pronunciations of the quantifier ‘some’, which vary by pitch and duration, used in the experiment. The participant decides if the statement is accurate or inaccurate based on their interpretation of the situation and the sentence, and in this way shows us which type of interpretation they have of ‘some’ in the context presented.

The deleted-vowel ‘sm’ was far more often accepted in the 4 out of 4 context, which means that an implicature was not generated. Three other variants of some were also analyzed and the acceptances were not statistically different. Therefore, we conclude that ‘sm’ may be a distinct lexical item than the other variants and that vowel duration is the most important factor

at play when deciding whether or not to generate an implicature. Also, inhibition and working memory were negatively correlated with acceptances in the 4 out of 4 context.

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Chapter 1: Introduction

The quantifier *some* in English can be pronounced in a number of ways and its meaning seems to vary as a function of this pronunciation. In 1, it appears that we could be talking about any plural number of children, while in 2, with *some* pronounced with a contrastive pitch accent, it seems clear that we intend to refer to a subset of a number of children under consideration.

1. Sm children went down the slide.

2. SOME children went down the slide.

Are these variants of *some* actual different lexical items or are they simply different phonetic variants of the same words? It is hard to know how to answer this question, but a first step is to determine whether the variants have consistent meanings for adult English-speakers. Obtaining these adult English-speaker judgments of different phonetic variants of *some* is the goal of this project. Why would we think that *sm* vs. *SOME* are different words? In a language such as Spanish, *sm* appears to correspond to the quantifier *unos*, while *SOME* appears to correspond to the quantifier *algunos*, roughly. We turn to this distinction now.

1.1 The Thetic and the Categorical Judgment

Gutiérrez-Rexach (2001) analyzed the contrasting properties of the Spanish plural existential determiners *unos* and *algunos.* Both words translate to mean 'some' in English but are used in different contexts in Spanish. The quantifier used in a sentence depends on the judgement type, which can be thetic or categorical. A thetic judgement is simply a description of an event, state, or situation. According to the philosopher Franz Brentano, a categorical judgement contains both a subject and a predicate and consists of two mental acts: identifying the subject and making a

statement about it, which is known as the predicate. Kuroda (1972) demonstrated that thetic vs categorial judgement is marked in Japanese by the words “ga” (thetic) or “wa” (categorical).

Milsark (1974) claims that there is a significant distinction between the stressed (‘some’) and unstressed (‘sm’) variant pronunciation of ‘some’ in English. The stressed variant is considered a strong determiner and the unstressed variant is considered weak. Noun phrases that have only the quantificational reading are called strong and contain a strong determiner. Sentences that only have the cardinal reading are called weak and contain a weak determiner. This is an important difference given the hypothesis that a weak noun phrase is only compatible with a thetic judgement. The contrasting properties of the Spanish plural existential determiners *unos* and *algunos* demonstrate the relevance of this distinction. *Unos* is used in sentences with a thetic judgement and *algunos* is used in sentences with a categorical judgement. In English, ‘sm’ appears to act like lexical item with different semantic properties than the other pronunciations of ‘some.’ In this paper, we will be exploring to what degree ‘sm’ is like *unos* as a thetic judgement and how similar the other phonetic variants of some are to *algunos* as part of a categorical judgement.

1.2 The Quantity Implicature

It is common knowledge that there are differences in meaning between certain words known as formal devices. These differences depend on the sentence, the context, and the implicature. Implicature can be thought of as the assumptions we make when we hear a sentence**.** In some cases, the implicature is determined by the conventional meaning of the words**.** In other cases, nonconventional or conversational implicatures relate to certain general features of discourse, which will be further explained (Grice, 1975).

Firstly, our talk exchanges must be, to some degree, cooperative efforts. These exchanges are guided by the Cooperative Principle, which Grice describes as, "Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged (Grice, pp. 45)." There are four categories of the Cooperative Principle. The first category is quantity, which rules that speech should be as informative as required but not overly informative. The second category is quality, which dictates that what you say should be true. Next, there is relation. Speech should be relevant. Finally, there is manner, which rules that we should clearly express ourselves and not be obscure. These rules, or maxims, are the basis for the assumptions we make. Implicatures depend on the fact that speakers will generally speak in a manner that follows the maxims of the Cooperative Principle (Grice, 1975).

Conversational implicature must be capable of being worked out. The hearer relies on the conventional meaning of the words used, the Cooperative Principle and its maxims, the context of the utterance, and background knowledge. Also, all relevant items falling under the previous four listed must be available to both participants.

Following Grice's maxim of quantity, a speaker must be as informative as required but not overly informative. The most informative way to refer to all the members of a set is to use the quantifier 'all', even though it also true that if all the children go down a slide, then some of them have gone down the slide. The quantity maxim dictates the relationship between the members of a set. The speaker can either be referring to the entire set or a subset. Following Gutiérrez-Rexach (2001), this decision only applies to categorical judgments and not thetic judgements, since it is impossible to get inside the plural subject in a thetic judgement to say anything about the smaller atomic units that make up the set. In other words, the speaker could

be referring to a subset if *algunos* or *SOME* is used in a categorical judgement. Furthermore, the speaker is referring to the set if *unos* or *sm* is used in a thetic judgement.

While Gutiérrez-Rexach focuses solely on language, Grice argues that not only language, but higher order reasoning combined with language, calculates how we interpret what we hear. All language that participates in the quantity scale can be interpreted by using your ability to understand conversational contexts, which is known as pragmatics. The word 'some' is on the quantity scale, so higher order reasoning must be involved to determine the implicature versus the non-implicature interpretation. While the 'some' pronunciation is susceptible to these pragmatic calculations, 'sm' is not.

1.3 The Thetic and the Categorical Judgment in Child Spanish

Vargas-Tokuda et al. (2009) investigated the abilities of children to distinguish between the determiners *algunos* and *unos*. The Spanish language presents a unique opportunity to examine children's use of more context-independent lexical semantic knowledge versus context-dependent pragmatic knowledge. Despite their apparent truth-conditional equivalence, the determiners *algunos* and *unos* contrast in several respects.

Previous research suggests that *algunos* can produce a "some but not all" pragmatic implicature while *unos* can produce a similar, but not identical, "some but not others" implicature. Also, *algunos* is discourse-linked and *unos* is not. Vargas-Tokuda et al. found that Spanish-speaking children at the age of 5 are adult-like in their ability to generate implicatures with *algunos* and cancel them in downward entailing environments. Children are also aware that there is no implicature generated by *unos*, the meaning of which did not change in the children's

judgments, whether presented in simple past tense declarative or in downward-entailing environments (antecedent clauses of conditional sentences). The results of these experiments suggest that there is a significant role played by an innate linguistic capability in children that allows them to go beyond the simple input to make highly subtle judgments at a young age.

1.4 Duration, Pitch and the Interpretation of *some*

Thorward (2009) examined the role of vowel reduction and pitch accent in the creation and cancellation of pragmatic implicatures in English. In previous research, there has been a significant lack of attention to the role of these phonological properties.

In Thorward's study, three variants of the existential quantifier 'some' were studied. *Sm*, which consists of a syllabic nasal, lacks a vowel, and usually allows for a logical interpretation. *SOME*, which contains a full vowel and associates with a type of pitch accent referred to as L+H* pitch accent, in Autosegmental Metrical Phonology (Pierrehumbert 1980). A pitch accent marks a lexically stressed syllable, which often differs from other syllables in amplitude and length. In English, pitch accents are used to focus particular parts of an utterance in order to separate those parts from what is presupposed. The pitch accented variant of 'some,' referred to as SOME, usually has the pragmatically enriched 'some, but not all' meaning. The third variant, referred to as *some,* is more ambiguous. It contains neither a reduced vowel nor a pitch accent and it can have the logical or pragmatically-enriched interpretation.

Three experiments were completed. By analyzing hours of talk radio, the first experiment confirmed that all three variants of 'some' are used by adults in spontaneous speech. Experiment 2 was used to determine the role of vowel reduction and pitch accent in the generation and

cancellation of implicatures in adult English. Experiment 3 was identical except for the fact that all participants were children. In both experiments, participants were asked questions about scenarios performed by puppets.

It was found that one third of both adults and children were willing to create an implicature in a downward-entailing grammatical context with the pitch-accented *SOME*. This suggests that the pitch accent is important to the generation of implicatures in English. It also appears that vowel reduction is significant in the cancellation of implicatures since *sm* allowed for more implicature cancellation than *some* in both adults and children. Also, the presence or absence of a pitch accent is crucial to implicature cancellation because the deaccented *some* allowed for more implicature cancellation than pitch-accented *SOME* in both adults and children.

In conclusion, English differs from Spanish in the fact that the phonological properties of an utterance, such as the segmental property of vowel duration and the prosodic property of pitch accent, play an essential role in the creation and cancellation of pragmatic implicatures. Also, English children are able to use these properties to generate and cancel implicatures, though not always with the same frequency as adult speakers (Thorward, 2009).

Grinstead et al. (2010) extended Thorward's (2009) study to a larger population, again concerned with the effect of phonetic properties on the interpretation of *some.* Previous research has shown that children are capable of calculating and cancelling scalar implicatures associated with existential quantifiers but these studies did not control the phonetic properties of the quantifiers tested. In this particular experiment, phonetic properties that seemed important for implicature generation were systematically controlled for. They investigated the degree to which children and adults differentiate the implicature ('some, but not all') and the no-implicature interpretations of 'some' based on these three properties:

- Syntactic-semantic Context: implicature generating versus downward entailing context
- Vowel Duration: length of the vowel in the three variants of ‘some’ (the three variants studied in this experiment are the same variants examined in Thorward 2009)
- Pitch Accent: the presence or absence of a L+H* pitch accent

The experiment was between-subjects. Each child or adult group heard only one variant of ‘some’ in both implicature generating and implicature cancelling contexts. Video-taped stimuli of an experimenter manipulating toys while narrating her actions were presented in the form of truth value judgement tasks for each phonetic variant and each syntactic-semantic context. A lion puppet, voiced by the experimenter, described a scenario involving several animal figurines. A certain number jumped over a fence and the lion described how many had jumped over, using one of the quantifiers ‘some,’ ‘none,’ or ‘all.’ The ‘none’ and ‘all’ items were used as warm-up and filler items. Sentences included ‘some’ in the main clause and in downward entailing contexts in which ‘some’ appeared in the antecedent of a conditional. Stimuli sentences included a single predicate “to jump over the fence”.

The results suggest that adults heavily rely on the presence or absence of contrastive pitch accents when determining whether to calculate a ‘some, but not all’ implicature. Adults do not rely as heavily on vowel length. The prosodic cues of pitch accent and vowel reduction do not override the syntactic-semantic context entirely. On the other hand, children rely more heavily on vowel length and do not significantly rely on the placement of pitch accents. Results for children on the syntactic-semantic context suggests a lack of understanding of the stimuli and were not conclusive (Grinstead et al., 2010).

Galla (2020) further studied the effect of pitch and duration on adults’ understanding of quantity implicatures. Four variants of ‘some’ that appear to occur in natural speech were

studied: one with the vowel deleted (“sm”), one with a full vowel and a low pitch relative to the noun it quantifies (“some”), one with a full vowel and a pitch roughly equal to the noun it quantifies (“sOme”), and one with a full vowel and a low+high* pitch accent (“SOME”).

To control for the phonetic factors of vowel duration and pitch, pre-recorded stimuli were used. Participants were shown videos in which less than four or all four characters complete an action. A narrator made a statement about the video and the participant was asked to accept or reject the sentence. Each participant watched the same four warm-up videos in which ‘all kids’ or ‘no kids’ was used. Therefore, there was a correct and incorrect answer. For the experimental items, participants were split into four groups. Each group heard only one phonetic variant of ‘some.’ There were five experimental scenarios which each participant saw twice. In half of the videos (n = 5), 3 out of 4 characters completed an activity. In the other half of the videos (n = 5), four out of four characters completed the activity.

The results show that implicatures were roughly generated to the same extent with variants of *some* that have vowels (some= 32.5% acceptance, sOme = 22.2% acceptance, SOME = 27.5% acceptance). With “sm,” participants generated significantly less implicatures than with all other cases (sm = 80% acceptance). This suggests that adult English speakers rely more on the duration of the vowel than on pitch in implicature generation. This contradicts Grinstead et al. (2010), which suggested that adults focus more on pitch than vowel length. Galla concludes that ‘sm’ is a separate lexical item from ‘some’ and that further research could be done to support this idea.

1.5 Consecutive vs Simultaneous Action

Pratt et al. (2019) studied the effect of stimulus presentation on children's ability to generate "algunos, pero no todos" ("some, but not all") quantity implicatures. Previous research suggests that stimuli presented in a consecutive fashion do not show effects of retention interval duration. The retention interval refers to the amount of time elapsed between the end of the presentation of a stimulus and subsequent testing for that stimulus. In other words, when stimuli are presented in a consecutive fashion, there is no relationship between the length of time between stimulus presentation and recall, and how well that information is retained. On the other hand, stimuli presented simultaneously show effects of retention interval duration. The longer that simultaneously presented stimuli are held in working memory, the worse the retention. Ricker and Cowan (2014) show that the time interval between stimuli presented consecutively allow for memory consolidation. In Pratt et al. (2018), participants viewed 12 Truth-Value Judgement Tasks presented simultaneously. 97% of adults generated an "algunos, pero no todos" quantity implicature while only 8% of children generated the implicature. In Pratt 2019, the research question is as follows: "If the action in a Truth-Value Judgement Task is presented consecutively, plausibly allowing for greater memory consolidation in between the sub-events of the total event of, for example, going down a slide, will children's ability to generate "algunos, pero no todos" quantity implicatures be improved?"

They found that with consecutive presentation of the stimuli, adults were significantly different from 4 and 5 year-olds but not different from 6, 7, or 8 year-olds. With consecutive presentation of the stimuli, there appears to be a greater ability of children to generate quantity implicatures: 74% age-matched vs 8% in Pratt et al. 2018. This is consistent with greater memory consolidation taking place in the intervals between sub-events of the total event.

1.6 Question Under Discussion

Gualmini et al. (2008) focused on children's interpretations of sentences containing a negation and a quantifier. Sentence (1) is an example of this type of sentence. Previous research suggests that although children are capable of accessing inverse scope interpretations of these sentences, they resort to surface scope more often than adults. The surface and inverse scope interpretations are labelled as (a) and (b) respectively.

1. The detective didn't find some guys.
    a. It is not the case that the detective found some guys. = The detective didn't find any guys.
    b. There are some guys that the detectives didn't find.

It is likely that context plays an important role in scope assignment. Gualmini et al. present a model of how contextual information may guide scope assignment called the *Question-Answer Requirement* (QAR). It is based on the common assumption that every assertion is understood as an answer to a question. Under this model, children, like adults, interpret statements as answers to a particular question referred to as the *Question under Discussion.* They hypothesize that in sentences containing a negation and a quantifier, there is a unifying key factor common to most cases in which children do not select inverse scope when it is available to adults.

The QAR holds that differences in scope assignment between adults and children are not explained by a difference in grammatical competence or parsing mechanisms. Instead, children and adults have access to different ways of addressing the Question under Discussion depending on:

I. The availability to children of an interpretation that is unavailable to adults.

II. Children's inability to accommodate a question that is different from the Question under Discussion suggested by the context.

III. Children's inability to compute scalar implicatures to construct an interpretation that would address the Question under Discussion (Gualmini et al., pp. 207).

To sum it up, both children and adults prefer the scope assignment which allows them to address the Question under Discussion. It is possible that this interpretation will happen to coincide with surface scope, which gives rise to the illusion that children are only limited to surface scope. However, the QAR is a factor at play in Truth Value Judgement tasks and can explain children's behavioral pattern. Overall, the relevance of the QAR and QUD to our project is that the QAR could serve as a guide for how to construct the discourse used in a Truth Value Judgment Task, even one that is not about quantifier scope, but rather pragmatic implicatures.

In Gualmini et al. (2008), an explicit Question Under Discussion (QUD) was employed to help children access quantifier scope interpretations that are typically difficult for them. Pratt et al. (2018) studied whether an explicit QUD can facilitate the generation of implicatures. Also, two specific QUDs were compared to determine what level of specificity is important. Results indicated that adults, but not children, generated implicatures and that their judgements were more categorical than in previous studies. Adults generated an implicature 97% of the time with the explicit QUD. For comparison, adults generated an implicature only 80% of the time in Vargas-Tokuda et al. (2009). However, children generated far fewer implicatures than children in Vargas-Tokuda et al., at only 8% of the time. This could be attributed to the type of action depicted and to predicate type (consecutive and distributive in Vargas-Tokuda et al. and simultaneous and collective in Pratt et al. 2018). Pratt et al. (2019) isolates and directly compares

simultaneous vs consecutive stimuli and shows improvement with consecutive presentation. Finally, results suggested that general vs specific QUD were not significantly different.

1.7 Summary and Research Questions

As seen through the literature review, the quantifier 'some' has different interpretations depending on the pronunciation. Milsark (1974) first noted that there is a significant distinction between the stressed ('some') and unstressed ('sm') pronunciations, similar to the distinction between *unos* and *algunos* in Spanish. *Unos* is used in sentences with a thetic judgement and *algunos* is used in sentences with a categorical judgement. Similarly in English, 'sm' appears to act like lexical item with different semantic properties than the other pronunciations of 'some.'

There appears to be a difference in the generation of implicatures between 'sm' and other phonetic variants. However, results between studies are somewhat contradictory. Grinstead et al. (2010) analyzed three variants of *some* and found that adults rely on the presence or absence of contrastive pitch accents when determining whether to calculate a 'some, but not all' implicature and do not rely heavily on vowel length. Galla (2020) analyzed four variants of 'some' and found that adult English-speakers rely more on vowel length and less on pitch when deciding whether to generate an implicature.

The present study analyzes the same four variants of 'some' as Galla (2020): one with the vowel deleted ('sm'), one with a full vowel and a low pitch relative to the noun it quantifies ('someL'), one with a full vowel and a pitch roughly equal to the noun it quantifies ('someH'), and one with a full vowel and a low+high* pitch accent ('someL+H*'). Galla (2020) follows Pratt et al. (2019) in presenting stimuli in a consecutive fashion. Pratt et al. (2019) found that

there appears to be a greater ability of children to generate quantity implicatures with consecutive presentation of the stimuli. The present study employs consecutive presentation of the stimuli for this reason, as it may be used with children in the future.

As in Galla (2020), this study seeks to determine whether adult English speakers depend more on the pitch or vowel/word duration of *some* when determining whether or not to generate an implicature. Furthermore, like Galla (2020), we also measure the inhibition component of executive function. However, the methodology is distinct. In the present study, data was collected completely virtually, with no in-person interaction between researcher and participant. Unlike Galla (2020), who gathered inhibition data using the Flanker Task direct measure, this study uses the BRIEF-A self-report measure of executive function, which allows us to collect data virtually.

The research questions in this experiment are as follows:

1. To what degree is 'sm' like *unos* as a thetic judgement and how similar are the other phonetic variants of 'some' to *algunos* as part of a categorical judgement?
2. What role do the phonetic factors of pitch and vowel duration play in the generation of implicatures with the word 'some' in monolingual adults that speak English?
3. Is adult executive function predictive of the implicature of 'some'?

Chapter 3: Methods

3.1 Participants

The study was conducted on 19 typical, English-speaking adults in Columbus, Ohio. The mean age was 317.61 months, a standard deviation of 154.30, and an age range of 219 to 770 months. Two participants were excluded because they failed the filler items.

3.2 Procedures

All participants signed a university IRB-approved consent form. Participants first joined a Zoom call with the researcher. Before starting the experiment, a self-report executive function task was performed: the BRIEF-A, which stands for Behavior Rating Inventory of Executive Function-Adult Version. The BRIEF-A was delivered as a Qualtrics survey, with items such as "I have angry outbursts" or " I have a messy closet." Participants were asked to rank themselves on these behaviors as "Often," "Sometimes," or "Never." (Roth and Gioia, 2005). The researcher sent the link to the survey in the Zoom chat and the participant completed the survey while on the Zoom call. After the survey was finished, the experiment portion began.

The experiment was delivered via SuperLab Remote, which was developed by the Cedrus Corporation as a way of delivering experiments through participants personal computers. Participants were walked through how to download and open the program on their own personal computers. The participant completed the experiment while still on the Zoom call. The experiment consisted of a series of warm-ups followed by Truth Value Judgement Tasks (TVJT), following the core elements of the original version of the Truth Value Judgement Task from Crain & McKee (1985), though modified by presenting the stimuli using narrated stop-motion videos.

First, each participant watched the same four warm-up videos in which either 0 of 4, 2 of 4, or 4 of 4 agents completed the activity of crossing a bridge. The video of the characters crossing the bridge was narrated, which always ended with a target sentence that said either "I know! All the kids crossed the bridge," or "I know! No kids crossed the bridge." The participant decided whether the statement was an accurate description for what occurred in the video. Therefore, there was a correct and an incorrect answer for the warm-up exercises. The purpose of the warm-up videos was to get the participant accustomed to the task.

Following our between-subjects design, participants were split in four groups for the experimental portion of the study. Each of the four groups heard a different phonetic variant of 'some.' The first group heard the full-vowel 'some', in which the quantifier has the same pitch as the following noun (someH). The second group heard the deleted vowel variant 'sm.' The third group heard the low + high* pitch-accented 'some'(someL+H*). Finally, the fourth group heard the full-vowel version of 'some', in which the quantifier had a lower pitch than the following noun (someL) (the same was true of the deleted vowel variant). These versions of 'some' were used in the target sentences in the TVJT videos following the warm-up exercises.

Following Crain & McKee, the TVJT videos included plausible dissent, which means that the answer given at the end of a task could plausibly be true or false. This is accomplished by the narrator casting doubt on whether the action under consideration is possible and having the characters discuss whether they should carry out that actions.

1. "The kids are home. They want to go upstairs and watch TV. Oh no! The ladder is really tall."

The characters huddle to discuss ladder climbing after the narrator makes the statement about the height of the ladder, as shown in Figure 1. Then, the narrator asks the Question Under Discussion, following Gualmini et al. (2008).

Figure 1: Children huddle to discuss after narrator comments on ladder

2. "Who will climb the ladder?"

The characters then consecutively climb the ladder, as shown in Figure 2, and the task ends with the narrator producing the critical experimental sentence.

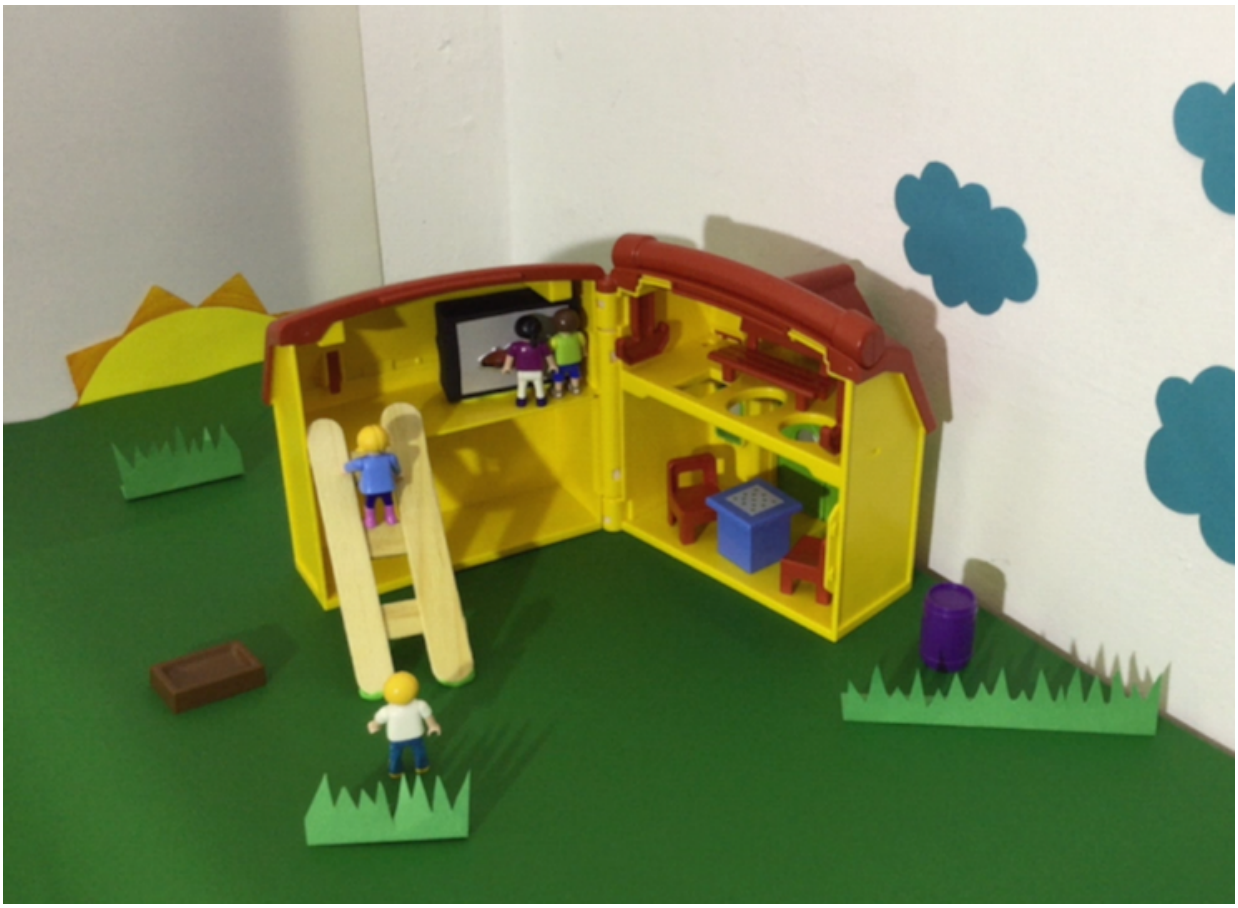

Figure 2: Children consecutively climb ladder to watch TV

3. “I know! Some kids climbed the ladder.”

This final sentence is designed to be pragmatically felicitous with a quantity implicature, if 3 of the 4 children climbed the ladder or infelicitous if all 4 of the 4 children went up, which clashes with the “some, but not all” quantity implicature.

There were five experimental scenarios, which each participant saw twice. One time, 3 of 4 agents completed the activity and the other time, 4 of 4 agents completed it. The audio stimuli were recorded by a trained phonetician in a sound booth and checked by a research assistant to ensure there were no statistical outliers and that each phonetic variant was statistically different from the others in vowel duration, word duration, and/or maximum fundamental frequency, as

detailed in Galla (2020). iMovie was then used to pair the audio files with the video clips. A full list of target sentences can be found in the appendix.

Along with the warm-up exercises and experimental items, filler sentences were used. Similar to the warm-ups, filler sentences used "all" or "none" and therefore had a correct and incorrect answer. Fillers were used to filter out participants who appeared to not understand the task or who were not paying attention. Only participants who answered all four filler items correctly were included. 2 participants were excluded for this reason. A full list of warm-up and filler sentences can be found in the appendix.

3.3 Materials

The stimuli used for the experiment were prepared by Laurie Maynell, a trained phonetician. Special care was taken to ensure that each phonetic variant was distinguishable. According to Galla (2020), "The first phonetic variant of *some* is the reduced form, with a completely deleted vowel: "Sm." Next is the "some – deaccented" case. This phonetic variant has a full vowel and no pitch accent on *some*. The pitch of *some* is lower than the pitch of the noun following. Third is the "some – accented" case. This phonetic variant has a pitch on the word *some* and a full vowel. The pitch of *some* roughly matches the pitch of the noun that follows. Lastly, the "pitch accented some" has a unique pitch contour." Galla (2020) used PRAAT software with each sentence to determine the word length, the vowel length (if applicable), the quantifier maximum pitch, and the noun maximum pitch. These values and the calculated the difference in pitch between the quantifier and noun can be found in Table 1 below. PRAAT data from the pitch-accented SOME can be seen in Figure 3.

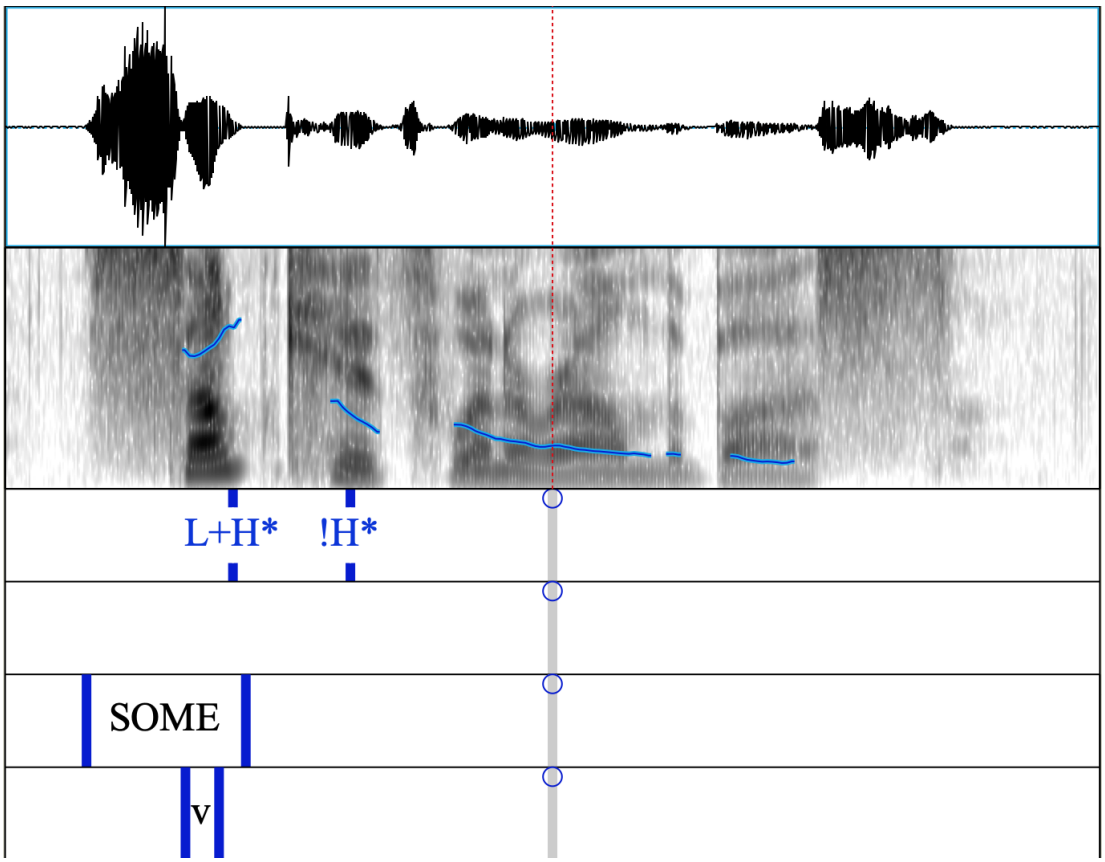

Figure 3: PRAAT data for pitch-accented SOME (Galla, 2020)

Item	*Some* variant	Quantifier Word Length (sec)	Quantifier Vowel Length (sec)	Quantifier Maximum F0	Noun Maximum F0	Difference between Quantifier and Noun F0
1	sm	0.2298	0.0000	229.2143	316.2640	87.0497
2	sm	0.2041	0.0000	237.1901	307.2835	70.0934
3	sm	0.2182	0.0000	233.0148	316.3041	83.2893
4	sm	0.2308	0.0000	237.0484	304.1953	67.1469
5	sm	0.2203	0.0000	232.0320	296.7954	64.7633
1	some - deaccented	0.2689	0.0616	234.4554	254.2335	19.7780
2	some - deaccented	0.2827	0.0600	236.4112	257.2646	20.8534
3	some - deaccented	0.2786	0.0639	239.2883	251.4792	12.1908
4	some - deaccented	0.2680	0.0657	244.0870	258.6222	14.5353
5	some - deaccented	0.2841	0.0658	244.5142	248.7546	4.2404
1	some - accented	0.3037	0.0645	232.7820	305.1850	72.4029
2	some - accented	0.2902	0.0643	224.6396	291.4257	66.7861
3	some - accented	0.3015	0.0674	229.4586	305.2635	75.8049
4	some - accented	0.2813	0.0606	224.0825	288.2608	64.1783
5	some - accented	0.3035	0.0690	228.4089	292.8397	64.4308
1	some – pitch-accented	0.3227	0.0680	369.6516	206.9885	-162.6631
2	some – pitch-accented	0.3373	0.0698	376.3208	223.0645	-153.2564
3	some – pitch-accented	0.3180	0.0720	416.7447	213.2285	-203.5162
4	some – pitch-accented	0.3327	0.0689	409.7815	204.1055	-205.6760
5	some – pitch-accented	0.3554	0.0706	394.6066	219.8773	-174.7293

Table 1: Phonetic information from Galla 2020, page 29-30, Table 1

3.4 Results

The results were gathered from the output of the SuperLab Remote experiment, which was presented in an Excel table that included the participant response (true or false) and response time for each warm-up, filler, and experimental item. In order to address the research question,

the experimental stimuli included scenarios in which 3 out of 4 agents completed the activity and in which 4 out of 4 agents completed the activity. Acceptance was counted as 1 and if the participant did not accept the sentence, it was marked as 0.

In the scenarios in which 3 out of 4 agents completed the activity, participants appeared to accept all phonetic variants of 'some.' When 4 out of 4 agents completed the activity, *sm* was accepted far more often than any other variant. The means and standard deviations of acceptances in 3 out of 4 scenarios and 4 out of 4 scenarios can be found in Table 2. Figure 3 summarizes the mean acceptance for each scenario and context. Note that the higher the acceptance for a phonetic variant, the fewer implicatures generated. If "sm kids" was accepted when 4 out of 4 kids completed the activity, then the "some but not all" implicature was not generated.

	sm		someL		someH		someL+H*	
context	3 of 4	4 of 4	3 of 4	4 of 4	3 of 4	4 of 4	3 of 4	4 of 4
mean	1.00	.44	.70	0.00	.92	.04	1.00	0.00
SD	0.00	.51	.47	0.00	.28	.20	0.00	0.00

Table 2: means and SD's of all variants and contexts

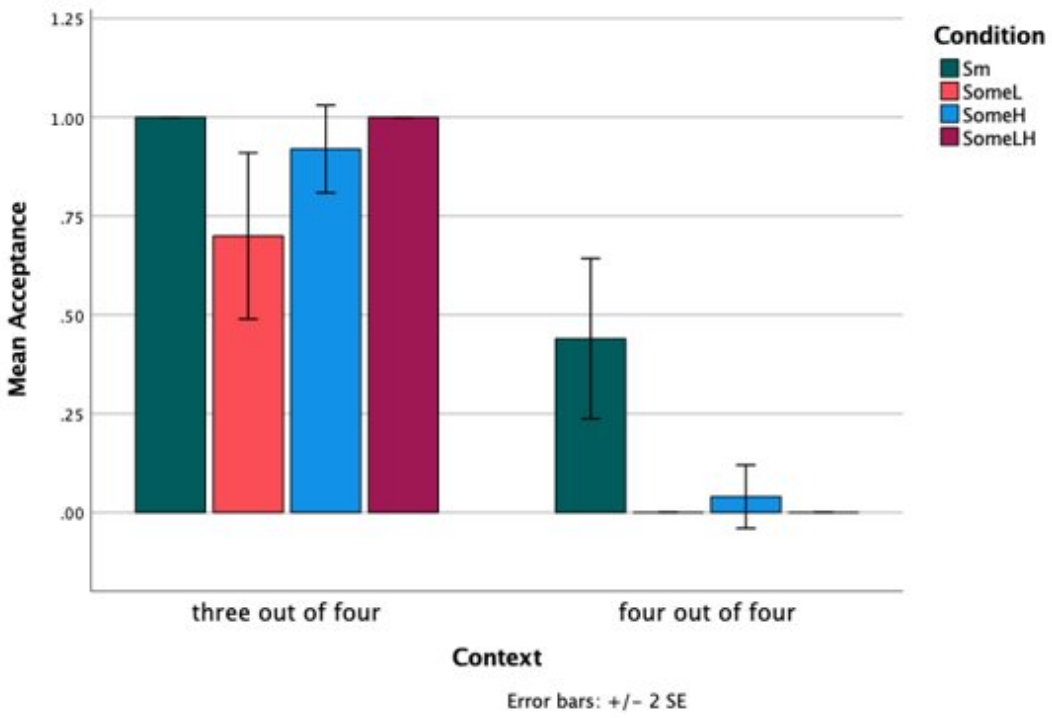

Figure 4: Mean acceptance of all variants and contexts

A Univariate ANOVA comparing acceptance of variants of 'some' in 4 of 4 contexts showed an overall r^2 of .707. Also, there was a significant main effect of context ($p<.001$) and condition ($p<.001$) and a significant interaction ($p=.001$). A similar univariate ANOVA of variants of 'some' in 3 of 4 contexts showed no significant main effects or interactions ($p > .05$).

Executive function was measured via the BRIEF-A and the results were gathered from the Qualtrics survey. BRIEF-A scores were calculated using the participants responses to questions in each area. 1 for *Never*, 2 for *Sometimes*, and 3 for *Often*. In this experiment, scores for Inhibition and Working Memory (WM) were analzyed. For example, "I am impulsive" is a sample item that measures inhibition. If the participant answered *Often,* 3 points would be added to their Inhibit score. The score range for Inhibition and WM is 8-24 (Roth and Gioia, 2005). A

summary of the means and standard deviations of the BRIEF-A scores for Inhibition and WM for the between-subject condition participant groups, by variant of 'some', can be found in Table 3.

	sm		someL		someH		someL+H*	
	Inhibition	WM	Inhibition	WM	Inhibition	WM	Inhibition	WM
mean	10.40	9.40	13.00	14.50	11.00	12.60	10.75	12.25
SD	1.95	2.19	3.56	3.70	2.00	1.95	2.63	4.35

Table 3: Summary of BRIEF scores for each condition

Univariate ANOVAs for working memory and inhibition showed no significant main effect of group, in either case ($p > .05$). On this basis, we conclude that our small sample is nonetheless rather homogenous in its executive function abilities, by between-subject group.

Both inhibition and working memory measures, even in our small sample of 19 participants, significantly negatively correlated with implicature generation, which is to say acceptance in 4 of 4 contexts, as illustrated in the following correlation matrix.

Correlations

		44acc	34acc	Inhibition	WM
44acc	Pearson Correlation	1	.240	-.477*	-.472*
	Sig. (2-tailed)		.337	.045	.048
	N	18	18	18	18
34acc	Pearson Correlation	.240	1	-.415	-.343
	Sig. (2-tailed)	.337		.087	.163
	N	18	18	18	18
Inhibition	Pearson Correlation	-.477*	-.415	1	.819**
	Sig. (2-tailed)	.045	.087		<.001
	N	18	18	18	18
WM	Pearson Correlation	-.472*	-.343	.819**	1
	Sig. (2-tailed)	.048	.163	<.001	
	N	18	18	18	18

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4: Correlation matrix of inhibition and WM with 4 out of 4 acceptance

The following overlay scatter-dot graph illustrates the relationship between inhibition and working memory measures, on the x axis, and acceptance of variants of 'some' in 4 of 4 (implicature-generating contexts) on the y axis. As mentioned above, the lower the score on the BRIEF-A measures, the higher the ability. For example, a mean score of 1 on inhibition indicates greater inhibitory ability than a score of 3.

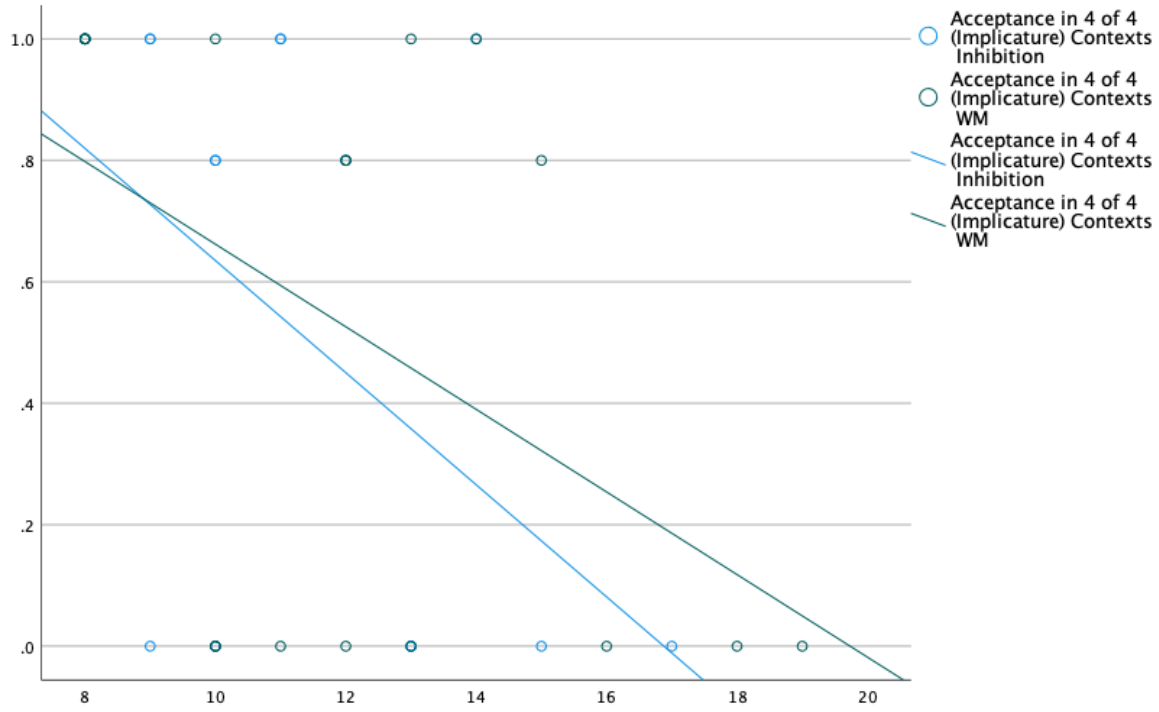

Figure 4: Scatter-dot graph of the relationship between inhibition and working memory measures, on the x axis, and acceptance of variants of 'some' in 4 of 4 (implicature-generating contexts) on the y axis.

Chapter 4: Discussion

This study attempted to answer three research questions. Question 1 seeks to determine the degree to which 'sm' like *unos* as a thetic judgement and how similar the other phonetic variants of 'some' to *algunos* as part of a categorical judgement. During this study, 'sm' was accepted far more often than the other three variants in the 4 out of 4 context, which means that the 'some but not all' implicature was not generated. The other three variants were hardly accepted in the 4 out of 4 context. These findings indicate that 'sm' could be a distinct lexical item from the other variants of 'some,' similar to the distinction between *unos* and *algunos*. Like *unos,* 'sm' is accepted in the 4 out of 4 context and like *algunos,* the other three variants are mostly only

accepted in the 3 out of 4 context, thus generating an implicature. Future research could compare the use of the different variants in sentences containing thetic and categorical judgements.

Question 2 seeks to determine the role in which the phonetic factors of pitch and vowel duration play in the generation of implicatures with the word ‘some’ in monolingual adults that speak English. ‘Sm’ was the only variant with statistically significant differences in acceptance. The other three variants (‘some’ with an equal pitch to the following noun, ‘some’ with a lower pitch than the following noun, and the pitch-accented ‘some’) all contain a full vowel. Therefore, we can conclude that in this study, the factor of vowel duration was more relevant than pitch in implicature generation.

These acceptance rates are similar to Galla (2020). Both studies reported ‘sm’ being accepted more than any other variant in the 4 out of 4 context. Also, both studies reported no statistically significant difference in acceptance between the other three variants. It is interesting that similar results were obtained, given the distinct methodology. Galla’s data was collected face-to-face while the present study utilized a fully remote methodology. Online research may be a way to reach more participants in less time while still obtaining reliable results. More work should be done to develop online experiment programs, such as SuperLab Remote.

Finally, Question 3 seeks to determine if adult executive function is predictive of the implicature of ‘some.’ Acceptances in the 4 out of 4 context were found to be negatively correlated with both inhibition and working memory (WM) scores, which means that higher acceptance rates were associated with lower inhibition and memory scores. As a reminder, lower BRIEF-A scores indicate higher ability. The Inhibition score of the BRIEF-A measures the participant’s ability to resist and not act on an impulse. The WM score measures the participant’s capacity to “actively hold information in mind for the purpose of completing a task or generating a response.” (Roth and Gioia, 2005).

Why would executive function variables correlate with the acceptance of ‘some’? One idea is that the different phonetic versions of ‘some’ are more or less appropriate for the two pragmatic contexts (3 out of 4 and 4 out of 4) in which we have presented them. Participants will need to inhibit inappropriate matches of phonetic variants and pragmatic contexts, in order to reject them. The importance of this matching may be visible in participants inhibition-acceptance correlation in 4 of 4 contexts, but not in 3 of 4 contexts, in which all variants were equally acceptable. Recall that there were significant main effects of context and condition for 4 of 4 acceptance, but that 3 of 4 acceptance showed no significant main effects or interactions.

In conclusion, this study has yielded significant results, but further research should be done to increase the number of participants. It appears that ‘sm’ is a distinct lexical item from the other, full vowel pronunciations of ‘some.’ The ‘some but not all’ implicature is more often generated with the full-vowel variants of ‘some.’ Also, inhibition and working memory were negatively correlated with acceptances in the 4 out of 4 context. Future research could further analyze the relationship between executive function and the acceptance of ‘some’ and also compare the scores of self-report executive function tests, like the BRIEF-A, and direct executive function measures.

Chapter 5: References

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Appendices

Target Sentences:

Some kids went down the slide.

Some kids climbed the ladder.

Some kids jumped over the fence.

Some kids crossed the street.

Some kids went around the bus.

Warmup and Filler Sentences:

All the kids went in the pool.

No kids went in the pool.

All the kids crossed the bridge.

No kids crossed the bridge.